Patent Application of

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For

TITLE: AUTOMATICALLY CLOSING ADJUSTABLE CLAMP

CROSS REFERENCE TO RELATED APPLICATIONS: Not Applicable

SEQUENCE LISTING OR PROGRAM: Not Applicable

BACKGROUND --FIELD OF INVENTION

This invention relates to bar clamps used in manufacturing, specifically for such clamps used to temporarily hold together two or more pieces for gluing, machining, aligning, or other processes.

BACKGROUND --PRIOR ART

The concept of a bar clamp with one active, movable jaw and one inactive, fixed jaw is very well known. U.S. patent #2,815,778 to Holman (1957) shows the basic design. While ubiquitous and indispensable, these clamps are difficult to use in less than optimal conditions because two hands are required to operate the clamp itself, leaving no hands available to hold or align the work. In woodworking, for example, when gluing parts together for a final assembly, several things are happening at once; the glue is beginning to dry, the parts have to be maintained in precise alignment while the clamps are attached, and freshly machined, cut, or finished surfaces have to be protected from glue drips, dents, and damage from the clamps themselves. Although time is of the essence and the work must be held correctly, both hands are required to operate the clamp. A third hand would often be useful.

U.S. patent 4,926,722 to Sorensen et al, (1990) shows one attempt to address this problem. In this design, a fixed jaw it attached to one end of a rigid bar, and a movable jaw is made to travel forward along the bar by repeatedly squeezing and releasing a spring loaded handle attached to the movable jaw. A series of locking cams are engaged and disengaged in sequence, which causes the

jaw to move incrementally along the bar until it contacts the work being clamped. However, there are several drawbacks with Sorensen's design. First, while it is possible to hold the bar and move the active jaw with one hand, the movement along the bar is in very small increments. To move the jaw a longer distance along the bar requires the use of a second hand, thereby eliminating the design's main advantage. Also, the grip-and-squeeze motion which moves the jaw along the bar is inefficient and soon becomes tiring. Another major drawback is that the amount of clamping pressure available to the user is limited by the mechanism which causes the jaw to move. Once the movable jaw finally arrives at the work piece, the operator can do no more than keep squeezing the grip to apply the clamp's maximum pressure. This mechanism functions primarily as a means of moving the jaw along the bar and is often not capable of applying sufficient pressure to the work. Another drawback is that it requires a separate mechanism to release the pressure; this mechanism does not allow a reverse one-handed movement of the active jaw along the bar. Finally, it is very complex, requiring any number of keys, cams, springs, etc., all of which are subject to wear.

U.S. patents 4,088,313 to Pearson (1978) and 4,563.921 to Wallace (1986) also both propose one-handed operation, but these are pliers-type designs. They are difficult to adjust for larger objects and therefore of limited use.

BACKGROUND--OBJECT AND ADVANTAGES

Accordingly, several objects and advantages of the present invention are:

(a) to provide an improved clamp,

(b) to provide a clamp with an active jaw which can be moved smoothly and rapidly any distance along the length of the bar using one hand only,

(c) to provide a clamp in which the final tightening process is not limited by the mechanism which moves the jaw along the bar, and,

(d) to provide a self-closing clamp which does not require a separate mechanism in order to release the clamping pressure.

Additional objects and advantages are to provide a self-closing clamp which is useful in a variety of manufacturing situations, which can be used to secure work pieces to each other or to an assembly bench quickly and easily, which is is useful in complex situations where hands are needed for precise alignment of parts or other functions, and which can be installed and removed with one simple motion. Further objects and advantages will become apparent from a consideration of the ensuing description and drawings.

SUMMARY

In accordance with the present invention an automatically closing clamp comprises an elongated body made up of two telescoping sleeves one inside the other, with a fixed jaw attached to one end of the inner sleeve. A movable jaw is made to travel back and forth along the inner sleeve by means of a flexible band routed around a spindle at each end of the inner sleeve. The two ends of this flexible band are attached to opposite ends of the outer sleeve in such a way that when the outer sleeve is drawn back, the movable jaw moves forward against the fixed jaw and can then be tightened by means of a handle on a threaded shaft.

DRAWINGS--FIGURES

Figs 1A and 1B show a perspective view of an exterior body of a clamp in accordance with the invention.

Fig 2A shows a vertical section taken lengthwise through the center of the clamp, with its two jaws separated.

Fig 2B shows a similar vertical section, but with the two jaws under pressure against the work piece.

Figs 3A and 3B show a side view of the clamp's exterior in open and closed positions.

Figs 4A and 4B show a horizontal section through the clamp body, with the clamp in open and closed positions, respectively.

Fig 5 shows a cross section of the clamp body, taken through section line 5--5 in Fig 2A.

Fig 6 shows a cross section of the clamp body taken through section line 6--6 in Fig 2A.

Figs 7A and 7B show the routing of an operating band with movable jaw in open and closed position.

DRAWINGS--REFERENCE NUMERALS

10 outer sleeve	11 vertical face
12 inner sleeve	14 slot
16 fixed jaw	18 movable jaw
20 front rotating spindle	22 rear rotating spindle
24 operating band	26 front fixed point
28 rear fixed point	29 groove
30 threaded shaft	32 pad
34 handle	36 hardened plate
38 work piece	

DETAILED DESCRIPTION--FIGS 1--6 -- PREFERRED EMBODIMENT.

A preferred embodiment of a self-closing clamp according to the present invention is illustrated in Figs 1-6. The body of the clamp comprises an outer sleeve or tube **10** and an inner sleeve or tube **12** (Figs 1A,B). These sleeves are of identical length, with inner sleeve **12** being sized so that it will slide freely within outer sleeve **10**. Each sleeve has a rectangular cross-section. A longitudinal slot **14** (Figs 5, 6) is cut into the bottom face of outer sleeve **10** and a longitudinal slot **14** is cut into the bottom face of inner sleeve **12.** When inner sleeve **12** is fully enclosed within outer sleeve **10**, this slot provides access to the interior of inner sleeve **12**. Inner sleeve **12** has a short vertical face **11** on each side of the slot.

Enclosed within inner sleeve **12** are two jaws of the clamp (Fig 2A). A fixed jaw **16** is attached to the front end (left end in Fig 2A) of the inner sleeve, and a movable jaw **18** is free to

slide back and forth along the length of the inner sleeve. Jaws **16** and **18** (Fig 5) each have an upper portion and a lower portion, and are shaped so that the upper portion is contained within inner sleeve **12** and the lower portion extends down through slot **14**.

Figs 7A and 7B show a cross-sectional view of the telescoped sleeves taken from above with the top faces of both sleeves removed. An operating band **24** (Figs 7A,7B) is connected to movable jaw **18** and is attached to outer sleeve **10** at two fixed points; a front fixed point **26** and a rear fixed point **28.** From front fixed point **26** band **24** passes down one side of the space between inner sleeve **12** and outer sleeve **10** to a rear rotating spindle **22** located at the rear end of inner sleeve **12.** Spindle **22** is fixedly attached to the rear end of inner sleeve **12.** The band is routed around spindle **22** (Figs 7A, 7B) and then up inside inner sleeve **12** until it attaches to the upper portion of movable jaw **18.** From there the band continues forward along the inside of inner sleeve **12** to a front rotating spindle **20** located directly behind fixed jaw **16.** Spindle **20** is fixedly attached to the front end of inner sleeve **12.** It passes around this spindle and returns back down inside inner sleeve **12** until it reaches the end of the sleeve, where it emerges from inner sleeve **12** and attaches to outer sleeve **10** at a rear fixed point **28.**

The upper portion of fixed jaw **16** (Fig 2B) conforms to the cavity of the inner sleeve **12** with the exception of a horizontal groove **29** which allows operating band **24** to pass by it on its way to and from front spindle **20** (Fig 2B).

The upper portion of movable jaw **18** is similar, except that groove **29** is only present on one side of the jaw. A hardened metal plate **36** (Figs 2A, 2B) is fastened to the back of the upper portion of the jaw.

The lower portions of the two jaws are of sufficient stiffness to withstand the working pressure of the clamp and are provided with a flat face or pad **32** which contacts the work being clamped. Movable jaw **18** (Figs 1A, 1B) has a drilled and tapped hole at its bottom end through which a threaded shaft **30** is passed. A swivel pad **32** is mounted on the front end of this shaft, and a handle **34** is provided for tightening on the other end.

Both jaws of the clamp and inner sleeve **12** are made of steel or other material suitably stiff to withstand the working pressure of the clamp. Outer sleeve **10** may be made of a heavy plastic or equivalent, since it does not have to withstand clamping pressure. Handle **34** is made to fit comfortably in the hand, and preferably is made of wood. Hardened plate **36** is made of material slightly harder than inner sleeve **12.** Operating band **24** is made of a non-stretch material such as a woven metal alloy or zero-stretch plastic, which is flexible enough to pass easily around spindles **20** and **22.** The thickness of various components relates directly to the overall capacity of the clamp. Sidewall thickness of approximately .1875 in. and a cross section of approximately 1 by 1.25 in. should be sufficient for a clamp with an 18" capacity. The longer the two sleeves, the heavier the individual components need to be.

OPERATION OF THE PREFERRED EMBODIMENT

The operation of the clamp is as follows. The body of the clamp (Fig 1A) is positioned above the pieces to be clamped. The clamp is lowered onto work **38** (here shown as two blocks of wood) and then drawn back until fixed jaw **16** touches the left face of work **38.** With fixed jaw **16** and inner sleeve **12** to which it is attached thus immobilized, the operator continues to pull the clamp backward, holding it by outer sleeve **10.** As the operator pulls back outer sleeve **10** as indicated in Fig 7A, sleeve **10** draws back rear fixed point **28** of operating band **24.** As this happens band **24** is drawn around and rotates front rotating spindle **20** which is mounted on a vertical axis at the front of inner sleeve **12.** This motion of band **24** (Fig 7B) causes movable jaw **18** to be drawn forward along inner sleeve **12** until pad **32** on threaded shaft **30** contacts the right side of work **38** being clamped (Fig 2B).

As outer sleeve **10** is pulled more forcibly after jaw **18** contacts the right side of work **38,** the upper portion of movable jaw **18** continues to move forward slightly inside inner sleeve **12,** while the lower portion of jaw **18,** which extends down through slot **14** in both inner and outer sleeves **12** and **10** squeezes against the work more forcibly. This in turn causes movable jaw **18** to tilt slightly so that its upper portion (Fig 2B) is farther to the left than its lower portion.

The jaws thus squeeze and clamp the work. The operator then rotates threaded shaft **30** by turning handle **34** to exert additional pressure on the work. This causes movable jaw **18** to tilt even further inside inner sleeve **12**, so that the top edge of plate **36**, which is attached to the back of the jaw, is pressed up against the top of the cavity of inner sleeve **12** (Fig 2B). This causes movable jaw **18** to jam and thereby fix its position in relation to the body of the clamp.

The operator rotates handle **34** on threaded shaft **30**, to cause pad **32** to squeeze work **38** with as much pressure as is required.

Thus the operator is able to use the device to clamp work **38** tightly, with full vise force, by using only one hand. During this procedure the operator's other hand is free to monitor the relative position of the individual pieces being clamped, and make any last minute adjustments that may be necessary.

Removing the clamp is the reverse of the installation process. Holding outer sleeve **10** with one hand, the operator rotates handle **34,** causing threaded shaft **30** to back off until pad **32** no longer contacts work **38**. At this point movable jaw **18** is no longer under pressure. Plate **32** then disengages, and the jaw drops back to a vertical position relative to the clamp body.

The operator then moves outer sleeve **10** forward (Fig 7A). As this happens, front fixed point **26** of operating band **24** also moves forward, causing operating band **24** to be drawn around rear rotating spindle **22**. This reverses the direction of motion of operating band **24**, which then draws movable jaw **18** back along inner sleeve **12,** away from the front of the clamp. The clamp may then be lifted clear of the work, and is ready for use again.

Advantages

From the above description, a number of advantages of my automatically closing clamp become evident

(a) An operator faced with a complex assembly may direct all of his or her attention to the pieces to be assembled, without having to break concentration to get the clamps set up.

(b) Once adhesive is applied to the work, the operator is able to attach the clamp with one simple single-hand motion--the other hand is free at all times to monitor the relative position of the parts being clamped.

(c) The amount of pressure available to the operator is restricted only by the failure point or limit of the clamp components.

(d) The relative position of the two jaws can be changed quickly and easily, so that the clamp can be installed and removed in an efficient manner

Conclusion, Ramifications, and Scope

Accordingly, the reader will see that the automatically closing clamp can be used to hold together two or more pieces of material for gluing, test fitting, or alignment purposes, and may be quickly and easily removed once the operation is completed. In addition, the operator can bring the two jaws of the clamp together using only one hand; the other hand remains free to monitor the relative positions of the pieces being assembled. If final readjustments are required, it is a simple matter to back off the movable jaw just far enough to allow these adjustments to be made; again, only one hand is required for this operation so that the operator need not let go of the pieces being clamped together. Since this clamp is simpler to operate, the operator is able to concentrate more directly on the project at hand, and the clamp itself is less likely to be the source of difficulty or damage to the work pieces. Furthermore, this automatically closing clamp has additional advantages in that

- it provides a quick and efficient means of clamping two objects together
- it allows the operator to concentrate on the pieces to be clamped, rather than expending time and effort attending to the clamps themselves
- it allows the operator to keep one hand on the work pieces at all times, so that position and alignment can be continuously monitored until the final tightening

• it provides a means of clamping which is simple and quick to use, and therefore less likely to get in the way or cause damage to objects being clamped together.

• it provides a clamp which can be easily and quickly adjusted for realignment of the work pieces,and can be easily removed when the clamping process is completed.

Although the description above contains many specificities, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention. Many variations are possible. For example, the cross section of the two sleeves need not be rectangular. They can be circular, hexagonal, or some other shape. The operating band can be flat or round in cross section, and the spindles can also be pulleys. Additionally, the movable jaw can have a sharpened edge mounted on its leading edge so that the device can function as a shearing device.

Thus the scope of the invention should be determined by the appended claims and their legal equivalents, rather than by the examples given.